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FIRE FIGHTING TACTICS TRAINING SIMULATOR

CAPT ANTHONY J. KWAN
MSGT GEORGE F. HALL
MSGT JOHN A. HAMRE

3340 TECHNICAL TRAINING GROUP
FIRE PROTECTION TRAINING BRANCH
CHANUTE AFB, IL 61868

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The use of the simulator for Training Firefighting Tactics will increase the overall effectiveness, expertise, and competence of USAF senior fire officials. The evaluation of six test classes, comprised of thirty-eight students, representing a cross section of Air Force fire protection personnel, has shown that the simulator for firefighting tactics is an effective piece of training equipment. The feedback expressed by those attending the course of instruction and using the simulator has been overwhelmingly positive.

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PREFACE

This report was prepared by the Air Force Engineering and Services Center (AFESC), Tyndall Air Force Base, Florida 32403, and summarizes the results of the development and testing of the Simulator for Training Firefighting Tactics.

This report has been reviewed by the Public Affairs Office (PA) and is releasable to the National Technical Information Service (NTIS). At NTIS it will be available to the general public, including foreign nationals.

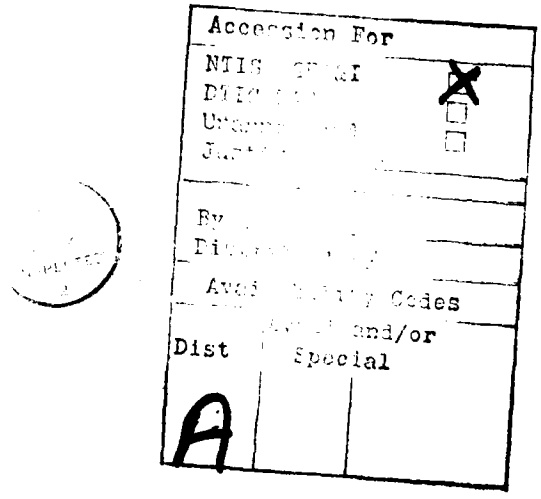
Appreciation is expressed to Master Sergeant George F. Hall, who was the primary data source for this report, and the 3340 Technical Training Group, Fire Protection Training Branch, Chanute Air Force Base, Illinois, which provided outstanding support and cooperation in the development of the simulator.

The technical report has been reviewed and is approved for publication.

ANTHONY J. KWAN, Capt, USAF
Project Officer

L. M. WOMACK
Chief, Engineering Research Division

FRANCIS B. CROWLEY, III, Col, USAF
Director, Engineering and Services Laboratory



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SECTION I

INTRODUCTION

1.1 BACKGROUND

Firefighting has a two-fold objective: saving lives and minimizing property loss. To efficiently accomplish these objectives, the Air Force has inevitably placed stress on:

1. Preplanning.

2. Attack and Extinguishment.

3. Post-fire Investigation and Analysis.

This general mode of operation has been followed since the mid-1960s. In the mid-1970s the Aircraft Crash Rescue Field Assistance and Evaluation Team (ACRFAET) identified a lack of demonstrated ability by senior fire officials* to effectively establish and maintain command and control during simulated firefighting operations. This downward trend was not the result of academic training received, but conversely, the lack of realistic hands-on training. Few agencies offered courses, compatible with the military environment, on command and control or on tactics and strategy. Textbook knowledge was minimal, as was experience. This was caused by attrition of military and civilian fire chiefs.

1.2 OBJECTIVES

The objective of this study was to increase the expertise and competence of USAF senior fire officials.

1.3 APPROACH

This project began with an investigation into the training apparatuses of commercial fire protection agencies. Two types of commercially available simulators were surveyed and found to be inadequate for Air Force training purposes. Therefore, an in-house effort was undertaken to design, construct and evaluate the fire tactics simulator.

The concept study and design was conducted by the Air Force Engineering and Services Center, Tyndall AFB, FL. It was determined that the optimum apparatus to achieve the objective was a scale layout of a typical Air Force installation. The construction, testing and evaluation of the tactics simulator was accomplished at the USAF Fire School, Chanute AFB, IL.

*Senior officials are fire chiefs, deputy fire chiefs, assistant fire chiefs, or any senior fire fighter on the fire ground representing the fire chief.

SECTION II

TACTICS SIMULATOR

2.1 DESCRIPTION

2.1.1 The tactics simulator consists of a horizontal display area approximately 15' x 33' upon which is mounted a 1":87" scale layout of a typical Air Force installation. There are seven student consoles on three sides of the simulator and an instructor's console on the end of the simulator facing the scaled airdrome. The simulator can be separated into nine sections to aid in maintenance and mobility.

2.2 SCALED AIRDROME

The scaled airdrome approximates, both in layout and construction, a typical USAF base.

2.2.1 The modeled components include: buildings, houses, streets, runways, street lighting, building and house lighting, taxi and runway lighting, street signs, building numbers, landscaping, contoured topography, railroad signs, parking lots, fire hydrants, military and civilian vehicles, aircraft, AGE units, movable fire trucks with hoses, smoke outlets, wind direction (fans), fires (lighting system), and other numerous devices.

2.2.2 Vital Statics. The vital statics of the tactics simulator include:

a. Length - 33 feet

b. Width - 15 feet

c. Height - 4.5 feet

d. Weight - 3,000 pounds (approximately)

e. Electrical Power - 115 VAC, 60 Hz, 30 Amps

f. Facility Air - 40 PSI, 4 CFM

g. Student console - 7

h. Instructor console - 1

i. Communications System - 1

j. Sound Effects System - 1

2.3 COMMUNICATION SYSTEM

This system is an eight-station intercommunication system that simulates a radio telephone network. Each student console has a hand-held, switch controlled microphone, single ear type headset, headset jack and a volume control. The system has an across talk capability. The instructor's console is equipped the same as the student console, and in addition, has a switch panel that can isolate any student console and a cassette recorder which can tape all conversations for later playback.

2.4 SOUND EFFECTS SYSTEM

The system consists of six continuous tape playback units, mixer-preamplifier, amplifier, and speaker systems. All units except the speaker system will be controlled from the instructor's console. This provides the instructor the capability of creating any number of background sound effects by controlling the volume and sound mixing.

2.5 MISCELLANEOUS SYSTEMS

The instructor's console has the capability of controlling room lighting for either daytime or night time operations and changing wind conditions to add realism to the fire situation. A venting system is installed in the classroom to dissipate the smoke used during training sessions. An opaque projector is mounted near the instructor console to display student prepared pre-fire plans.

2.6 EMERGENCY SCENARIOS

2.6.1 There are three basic emergency scenarios. These are emergency vehicle response routing, structural fire, and crash rescue.

2.6.2 The instructor console is capable of creating approximately fifty situations to which the student must respond. Each student console is equipped with an annunciator panel with fifty illuminating modules; each module contains a printed situation. When the instructor selects a situation and actuates the control switch, the situation is displayed on all seven student console annunciator panels simultaneously. The annunciator panel is mounted under "see no see" plastic and will not be visible to the student until the control switch is actuated on the instructor's panel. The students then make their decisions and move the pieces on the model board to implement their decisions.

2.6.3 Emergency Vehicle Response Routing Scenarios.

These scenarios have the capability of indicating the streets, taxiways and runways used by emergency vehicles

responding to a given situation. This is accomplished by sequenced strip lighting controlled from the instructor's panel. Included in this system are a number of instructor-controlled obstructions. Obstructions are presented to the student by the use of rotating panels. Two types of rotating panels are used. Both depict a normal situation; however, when the first type of panel is rotated 180°, the situation to which the student will react is displayed. For example, the normal situation may depict a number of vehicles approaching a street intersection. However, when the panel is rotated the abnormal situation will show the vehicles involved in an accident which blocks the intersection. The second type of device has the capability of indicating a normal scene plus two abnormal situations by rotating the panel 120° in either direction.

2.6.4 Structural Fire Scenarios.

The instructor console has the capability of simulating structural fire situations. Fire is simulated by special lighting effects. Smoke is generated and ducted to the various simulated fire areas. Sound effects are provided, and various structures have a collapsing wall capability.

2.6.5 Crash Fire and Rescue Scenarios.

The instructor console has the capability of simulating crash fire and rescue situations. This is accomplished by the use of rotating panels, simulated fire, smoke and sound effects. The rollover devices reveal crashed aircraft on the model board.

SECTION III

EXPERIMENTAL

3.1 TEST AND EVALUATION PROCEDURES

The tactics simulator was tested and evaluated by six classes, two weeks each, consisting of seven senior fire officers. Each senior fire officer and the class instructor completed a questionnaire concerning the operation, use and value of the tactics simulator.

3.1.1 Testing.

One instructor and seven senior fire officers participated in each training session. The students responded to inputs from the instructor. The communication system was used exclusively to direct changes in fire fighting tactics. The students kept themselves in a position such that their view of the fire situation would approximate what they would visualize from a command position. Recordings were made of the entire exercises for critiquing purposes.

3.1.2 Evaluation.

At course completion each student and class instructor completed a questionnaire on the simulator. Once all six classes completed the course the data was compiled and analyzed.

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SECTION IV

RESULTS

4.1 COURSE PARTICIPANT ANALYSIS: This analysis is derived from the simulator evaluation questionnaire as prescribed by the test plan. Table 1 reflects course participants by command, duty position, and rank. Table 2 reflects a numerical summary in positive and negative replies to the nine questions asked on the questionnaire. The following nine questions and summary of answers represent the general consensus of the thirty-eight participants and the three assigned staff personnel. The questionnaires can be found in the appendices.

4.1.1 Course Participants.

a. Is the simulator adequately equipped?

(1) Participants were generally satisfied.

(2) Students recommendations have been acted upon by providing more base maps, color coded hydrants, and directional indicators. Additionally the number of flightline incidents have been increased.

b. Is the simulator student-centered?

(1) Participants agreed that the effectiveness of the exercises caused total involvement by each player. Success or failure of an exercise was a joint, not singular responsibility.

c. Does the simulator meet the objective?

(1) Overwhelmingly, yes! The only negative reply was based upon this comment: "Other students are not familiar with my way of fire fighting."

d. What are your likes and dislikes about the simulator?

(1) There are numerous LIKES about the simulator. The three most predominant items were:

(a) Realism of the simulated operations.

(b) Thoroughness and effective evaluation of the scenarios.

(c) Post-exercise critiques and cross-feed.

(2) Three major DISLIKES appeared on thirty-five of the thirty-eight questionnaires. They were:

TABLE 1: BREAKDOWN OF COURSE ATTENDEES BY COMMAND, DUTY POSITION, AND GRADE/RATE

COMMAND	No.
SAC	12
TAC	14
MAC	0
PACAF	3
USAFE	2
ATC	7
	38

DUTY POSITION	No.
Fire Chief	12
Deputy	12
Acft Ops	5
Acft Trng	7
MAJCOM	2
	38

CIVILIAN GRADE	No.	MILITARY RATE	No.
GS-12	1	E-9	2
GS-11	11	E-8	2
GS-10	1	E-7	9
GS-9	7	E-6	3
GS-8	1	E-5	1
	21		17

TABLE 2. SUMMARY OF SIMULATOR EVALUATION QUESTIONNAIRE REPLIES

	QUESTION	Reply YES	NO
1.	Is the simulator adequately equipped?	28	10
2.	Is the simulator student-centered?	35	3
3.	Does the simulator meet the objectives?	37	1
4.	What are your likes and dislikes about the simulator?	NA	NA
5.	Does the simulator realistically exercise the student's capability to perform as command and control officer?	37	1
6.	Does the simulator realistically exercise your capability to coordinate information through the communications center to the firefighting operations and vice versa?	36	2
7.	Does the simulator realistically simulate each fire/aircraft situation?	33	5
8.	Would the simulator or portions of the simulator be effective for field base operations?	36	2
9.	What is your overall opinion of the simulator?	NA	NA

(a) Elevation is necessary for a more overhead view of the operation.

(b) The length of the headset communication system needs to be extended to provide maneuverability.

(c) Visibility by all participants is limited due to restrictive length of headset cord and size of the simulator.

(3) As a result of these expressed DISLIKES, the following actions were taken:

(a) Adjustable height chairs have been received and are currently in use.

(b) Headset cord extensions have been ordered to allow more maneuverability so that students can view the overall operation.

e. Does the simulator realistically exercise your capability to coordinate information through the communications center to fire fighting operations and vice versa?

(1) Yes. Additionally, one participant expressed the opinion that a student should serve as the fire alarm communications center.

f. Does the simulator realistically exercise your capability to perform from a command and control standpoint during fire situations?

(1) The participants felt they were tasked to their limit. Opinions can be summarzied by stating: scenario realism, decision-making processes, and post-exercise analysis provided a meaningful learning atmosphere that is above the caliber afforded a fire chief during any home base exercise.

g. Does the simulator realistically simulate each fire/aircraft situation?

(1) Yes.

NOTE: The instructor staff will be evaluating the possible use of 35mm slide projection imagery in conjunction with the exercises. This item will take some time to develop and implement, and if found to be effective, it will be incorporated into the course.

h. Would the simulator or portions of the simulator be effective for field base operations?

(1) Yes, but not on the same scale. Most students agree that a simulator (not as elaborate) could be developed at base level for generalized training of their departments.

i. What is your overall opinion of the simulator?

(1) Provided are some of the replies extracted from the questionnaires:

(a) Outstanding.

(b) Excellent.

(c) Long time coming.

(d) Exactly what we needed.

(e) Every Chief and MAJCOM representative should be exposed to it.

(2) There were no negative comments.

4.2 INSTRUCTOR ANALYSIS: Six questions were provided on the instructor evaluation questionnaire. All answers were "Yes."

4.3 MAINTAINABILITY: The simulator for training fire fighting tactics has an excellent record of maintainability. Since its initial use began on 16 January 1980, there have been sixteen trainer maintenance actions (see Table 3). It should be noted, however, that even though maintenance actions were required, there was no training time lost. All areas of the simulator are easily accessible for maintenance.

4.4 RELIABILITY: To date, reliability of the simulator for fire fighting tactics has been 100 percent. Even though maintenance actions have been required, the coordinated efforts of the 3340 TCHTG/TTMF and 3345 CMS/MAN resulted in no loss of training time. It should be noted, however, that if a major malfunction should occur in the master control panel, the accomplishment of training would be severely hampered. If this situation should arise, immediate corrective action will be taken to assure prompt return to service.

4.5 SAFETY: Safety is addressed to class participants in relation to their operation of the simulator. The instructor staff follows a detailed checklist in the operation of the simulator to assure precautions are followed.

TABLE 3. TRAINER MAINTENANCE ACTIONS

	MAINTENANCE ACTION REQUIRED	WORK ORDER NO.
1.	Spotlight at Station 1 inoperative.	0290161
2.	Communications system microphone at Station 3 malfunctioning (mike key).	0290162
3.	Instructor microphone head boom inoperative.	0290163
4.	Street lights at Section 6 not operable.	0290164
5.	Internal lighting inoperable in Buildings 110 and 119.	0290165
6.	Eight-track tape system out of adjustment (aircraft activity noise will not shut off).	0290166
7.	Vehicle on 5th Street facing wrong direction.	0290167
8.	Parking lot and street striping lines are peeling.	0290168
9.	Various figurines need regluing.	0290169
10.	Communications system microphone at Station 4 malfunctioning.	03090161
11.	Miscellaneous condition panel lighting malfunction at Station 4.	084161
12.	Several roll-over situations are out of adjustment.	0840162
13.	Street light stem broken on Section 5.	0840163
14.	Several roll-over situations are out of adjustment.	1130019
15.	Collapsible wall activation plunger out of adjustment.	1130020
16.	Street lights on Section 7 not operable.	1150161

SECTION V

SUMMARY AND CONCLUSIONS

The study and concept design of the tactics simulator was accomplished by the Air Force Engineering and Services Center, Tyndall AFB, Florida.

The construction, testing, and evaluation of the tactics simulator was conducted by the 3340 Technical Training Group, Chanute AFB, Illinois.

The development of the Advanced Fire Protection Technology course was accomplished by the 3340 Technical Training Group, Fire Protection Training Branch, Chanute AFB, Illinois.

The evaluation of six test classes, comprised of thirty-eight students, representing a cross-section of Air Force Fire Protection personnel, has shown that the Simulator for Firefighting Tactics is an effective training device. The feedback expressed by those attending the course of instruction and using the simulator has been overwhelmingly positive.

SECTION VI

RECOMMENDATIONS

The following items should be given strong consideration:

1. Course participants:

a. Every effort should be exhausted to assure that the maximum course quotas are filled. The simulator is designed to function with seven operators plus three instructors. Three of the six classes had six, six, and five students, respectively. Fortunately, instructors from other courses were available to fill positions. This type of contingency cannot always be satisfied.

b. Careful screening should be conducted by Consolidated Base Personnel Offices to assure personnel attending the course meet the stringent prerequisites.

2. The potential for use of a tactics and strategy simulator is not limited to the Fire Protection Air Force Specialty. Foreseeing the possibility of mini-simulators being built regionally, or locally, every effort should be made to test a similar program, with inclusion of members of the Disaster Response Forces. It is suggested that the technical schools for security police and disaster preparedness view the simulator in operation. At that point these agencies can evaluate the adaptation of a similar device for their curricula.

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APPENDIX A

INSTRUCTOR QUESTIONNAIRE

	YES	NO
1. Does the simulator allow the instructor to evaluate the student's performance?	___	___

Comments: _____

_____

_____

2. Does the simulator allow for flexibility?	___	___

Comments: _____

_____

3. Does the simulator provide for instructional feedback?	___	___

_____

4. Does the simulator provide realistic situations?	___	___

Comments: _____

_____

5. Does the simulator realistically exercise the student's capability to perform as a command and control officer?	___	___

Comments: _____

_____

_____

6. Does the simulator exercise the student's ability to coordinate information through the communications center to the fire scene and vis versa?	___	___

Comments: _____

_____

_____

APPENDIX B
STUDENT QUESTIONNAIRE

	YES	NO
1. Is the simulator adequately equipped?	___	___

Comments: _____

_____

_____

2. Is the simulator student centered?	___	___

Comments: _____

_____

_____

3. Does the simulator meet the objectives?	___	___

_____

_____

4. What are your likes and dislikes about the simulator?

Comments: _____

_____

_____

_____

_____

5. Does the simulator realistically exercse your capability to coordinate information through the communications center to the fire fighting operations and vis versa:

Comments: _____

_____

_____

6. Does the simulator realistically exercise your capability to perform from a command and control standpoint during fire situations? ___ ___

Comments: _____

_____

_____

7. Does the simulator realistically simulate each fire/aircraft situation? ___ ___

Comments: _____

_____

_____

_____

8. Would the simulator or portions of the simulator be effective for field base operations? ___ ___

Comments: _____

_____

_____

_____

9. What is your overall opinion of the simulator?

Comments: _____

_____

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